



May 14, 1999

17 10 01 11 1999

Mr. Marc Roy, Chief
Technical Services Section
Sites Management Section
Vermont Department of
Environmental Conservation
103 South Main Street
Waterbury, VT 05671-0404

RE: Raymond Hall Property, Westford (VDEC Spill #96-325) - Soil Vapor Survey Summary

Dear Mr. Roy:

Lincoln Applied Geology, Inc. (LAG) conducted a soil vapor survey related to the discovery of fuel oil contamination in the Raymond Hall shallow dug well in Westford, Vermont (Figure 1). Fuel oil leaked from a broken copper delivery line between a 55-gallon steel drum and the garage furnace, and an estimated 15 gallons of oil entered the subsurface, eventually contaminating the dug well with petroleum compounds. Photoionization detector (PID) levels of volatile organic compound in subsurface soils from depths of 1 to 3.5 feet indicate that petroleum impacts from the small fuel oil spill were minimal and limited. All PID readings were non-detect except for three locations adjacent to the spill area and dug well, where PID levels ranged from 1.0 to 29.3 ppm. Data indicates that the petroleum contaminants migrated about 15 feet from the spill area to the dug well within the more permeable backfilled water service trench. We suggest that the remaining limited fuel oil contamination present does not warrant soil excavation or additional remedial efforts.

Enclosed for your information and review of this report are the following attachments:

Figure 1 - General Location Map

Figure 2 - Site Map and Soil Vapor Survey Probe Locations

Table 1 - Soil Vapor Survey PID Results

Appendix A - Water Quality Laboratory Reports for October 27, 1998

Historical Summary

The following historical summary was presented in LAG's September 29, 1998 Work Plan and Cost Estimate Summary correspondence. It is included here to briefly explain the separate #2 fuel oil spill events, subsurface investigations, and remedial actions.

1996 LAG Investigation

As you are aware, LAG was initially contracted by Corporate Environmental Advisors, Inc. (CEA) of Massachusetts to investigate the contamination of soils on the Raymond Hall property on Reynolds (Old Stage) Road in Westford, Vermont (Figure 1). The on-site soils were contaminated from the accidental release of 5 to 20 gallons of #2 fuel oil on October 2, 1996 by Rowley Fuels (RF) of Milton, Vermont. RF overfilled the Hall's 275-gallon

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aboveground storage tank (AST), causing oil to be sprayed onto the ground and their residential trailer.

LAG performed an investigation that determined the areal extent of the soil contamination, and hired a contractor to excavate about 3 cubic yards of petroleum contaminated soil. The contaminated soil was drummed and properly transported and disposed of off-site. A small quantity of residual fuel oil contamination adsorbed to shallow soils near the AST could not be removed due to their close proximity to the trailer's underground electric service, water line, and concrete slab. The sample of the Hall's shallow dug well water supply located about 75 feet slightly upgradient of the spill location that was collected on November 12, 1996 contained no detectable levels of the petroleum compounds BTEX and MTBE, or total petroleum hydrocarbons (TPH).

1998 CEA Investigation

Apparently in November 1997 the Hall's noticed petroleum odors in the water supplied by the shallow dug well. Prior to that time CEA had formed a satellite office in Wilder, Vermont, and personnel from the CEA Wilder office responded to the Hall's complaint after being contacted by the VDEC to investigate the potential contamination of their water supply. CEA collected water samples on March 20, 1998 from the Hall residence tap. The samples were analyzed for volatile organic compounds (VOCs) by EPA Method 524.2 and TPH by EPA Method 8100M. The results indicated the presence of 44 parts per billion (ppb) BTEX, 2.3 ppb MTBE, 32 ppb substituted benzenes, 1.8 ppb naphthalene, and 0.2 parts per million (ppm) TPH. The type of petroleum could not be conclusively identified, however it was believed to be either #2 fuel oil or kerosene. On March 25th CEA installed a point-of-entry treatment (POET) system consisting of a 200 pound, liquid phase, granular activated carbon (GAC) filtration unit to treat and remove the contaminants prior to non-potable use of the treated water in the residence. The Hall's were also supplied bottled water for potable use.

After the ground thawed CEA conducted a limited subsurface soil investigation using hand augers on April 30 and May 1, 1998 to determine potential petroleum migration pathways between the 1996 fuel oil source and the well. CEA also installed a hand auger soil boring near the garage (located about 15 feet from the well) at the location of a broken copper delivery line from an exterior horizontally-placed 55-gallon drum to the garage furnace. The drum had apparently contained fuel oil or kerosene, however it and the garage furnace had not been used in the 15 years since the Hall's had purchased the property. The base of the drum appeared damp and may have leaked. Soils beneath the broken oil delivery line assayed (by PID) from 110 ppm at a depth of 0.5 feet to 16 ppm at a depth of 4.75 feet. Soil quality samples collected from a depth of 2 feet contained 190 ppb toluene, 2,100 ppb xylenes, and 4,700 ppm TPH. Soil samples in four borings augered between the well and the 1996 fuel oil source assayed only non-detect by PID.

Based on the results of the limited investigation, CEA concluded that the source of the petroleum in the Hall's shallow well was most likely the result of leakage from the 55 gallon drum/line. The evidence included: the location of the drum/line within 15 feet of the well; the



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unweathered condition of the copper line break and wetness of the drum base; the detection of elevated VOCs/TPH in soils via PID and laboratory analyses in the vicinity of the line break; the lack of detectable VOCs/TPH in soils between the well and the 1996 fuel oil source area and the lack of detectable TPH in soils in the 1996 source area; and the detection of petroleum odors by the Halls during November 1997, a year after remediation of the 1996 release event.

Since CEA's client, Great American Insurance Companies (insurer of RF for the 1996 fuel oil release), was not the responsible party for petroleum impacts to the Hall's well, they gave notice to the VDEC SMS that their water POET filtration equipment would be removed from the property after a 45 day period in order to allow the SMS or responsible party to coordinate a replacement POET system.

POET Installation and LAG Work Plan

The SMS hired Vermont Water Treatment Company (VWT) to install a POET system in August 1998. The system was also located in the unheated garage and effectively treated the contaminated water prior to its use in the Hall residence. The Petroleum Cleanup Fund (PCF) monies were used to pay for the POET system installation, operation, and maintenance. The PCF also paid for a limited investigation to determine the extent of the soil contamination in the vicinity of the former drum/line leak and the shallow well, and to determine appropriate remedial actions, if necessary. The soil vapor survey data and summary is presented below.

Soil Vapor Survey

On October 27, 1998 LAG conducted a subsurface soil vapor survey in the vicinity of the former drum/line leak and shallow well to determine the extent of petroleum contaminated soil. Since the shallow ground water surface was present at a depth of about 3.5 feet, AMS soil probes were manually driven into the soil at 21 locations to depths of 1', 2', 3', and 3.5'. At each depth a sample of soil gas was extracted using a vacuum pump and assayed by PID for the presence of VOCs. Soil probe locations were on a grid with 5' centers, as shown on **Figure 2**. Two probes were placed through the concrete floor within the garage. The survey continued outwards from the source area until there were no detectable levels of VOCs by PID. The maximum quantity of petroleum that could have been released from the drum was estimated by Ray Hall to be 15 gallons.

The data collected from the October 27, 1998 soil vapor survey was reported to you by telephone and FAX on November 13, 1998. The data indicates that the extent of soil contamination from the small fuel oil release was minimal. Soil PID results presented on **Table 1** show that all PID readings were non-detect (0.0 ppm) at 18 of the 21 probe locations. At the former spill area, probe locations H-5 and H-6 assayed detectable PID levels that ranged from 1.0 to 27.0 ppm from depths of 1' to 3.5', and probe location J-9 beside the pipe into the dug well assayed 12.8 to 29.3 ppm at a depth of 3' to 3.5'.

These data indicate that the small oil release impacted soils and the shallow ground water in the immediate area of the leak/spill, migrated in ground water to the north into the



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backfilled trench containing the water service, and then migrated to the west within the permeable trench where it entered the dug well via the pipe hole in the side of the concrete well tile. When opened on October 27th, the interior of the well had a faint "old" oil odor, but did not contain detectable levels of VOCs by PID.

Three water quality samples were collected from the POET system in the garage on October 27th, and the samples were analyzed for BTEX and MTBE, and TPH by EPA Method 8100M at Green Mountain Laboratories, Inc. (GML). The water quality results are presented as **Appendix A**, and indicate that BTEX and MTBE were not detected in the POET influent (to the first GAC), middle (effluent from the first GAC), and effluent (effluent from the second GAC) locations. A very low level of TPH was detected at the POET influent (0.25 ppm), none was detected from the middle, and 0.05 ppm was detected at the effluent. These results indicate that all the tested compounds are below the Vermont Primary Ground Water Quality Enforcement Standards (GWES).

Raymond Hall stated that the dug well ground water was not used for drinking prior to the contamination event and was not going to be used for drinking in the future. Apparently they had always hauled in drinking water from off-site, and the dug well water was used for bathing and washing. Since the POET influent water quality results showed no detections of BTEX and MTBE, and the TPH level was very low, the VDEC had the POET system removed by VWT in the fall of 1998.

Conclusions

Based on the historical data collected relative to: the 1996 fuel oil release, investigation, and remediation; the former garage fuel oil AST drum and furnace; the results from the CEA investigation; the results from the LAG soil vapor probe investigation; and the water quality results from the Hall's dug well water supply, the following conclusions are made:

- ▶ A small scale release of about 15 gallons of fuel oil from a garage drum AST occurred as a result of a leak or delivery line break after November 1996 and before November 1997.
- ▶ The oil release impacted soils and shallow ground water in the spill area and ground water in the dug well.
- ▶ The October 1998 soil vapor survey identified very limited and low residual levels of VOCs in soil at the oil spill location and beside the dug well.
- ▶ The October 1998 dug well ground water water quality results indicated no detectable levels of BTEX and MTBE, and only a very low 0.25 ppm TPH.
- ▶ These low levels of soil and ground water contaminants will likely continue to be naturally biodegraded and attenuated with time.
- ▶ The Hall's do not use the water from the dug well for drinking purposes.
- ▶ The POET system was removed by VWT with VDEC approval in the fall of 1998.



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Recommendations

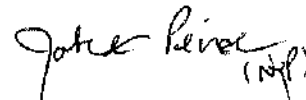
Based on the conclusions presented above, LAG recommends the following:

- ▶ In June and November 1999, collect water quality samples from the dug well and analyze them at GML for BTEX, MTBE, naphthalene, 1,3,5-trimethylbenzene, and 1,2,4-trimethylbenzene via EPA Method 8021B, and TPH via EPA Method 8100M.
- ▶ Report the water quality results to the VDEC by FAX and brief letter, along with any recommendations.
- ▶ Any further investigative or remedial actions are not recommended other than the biannual water quality sampling and reporting during 1999.

If the biannual water quality sampling results indicate that contaminant levels are below the GWES, then LAG will request that the site be granted a Spill Management Activity Completed (SMAC) designation.

If you have any questions or comments, please call me or Bill Norland, Project Manager, at 802-453-4384.

Sincerely,
Lincoln Applied Geology, Inc.



Jacob S. Peirce
Environmental Scientist

Reviewed and Approved By:
Lincoln Applied Geology, Inc.



William D. Norland
Hydrogeologist

JSP/njp

Enclosures

cc: Raymond Hall

F:\CLIENTS\SITES\RESIDENT\HALL\WEST\SLVR.599



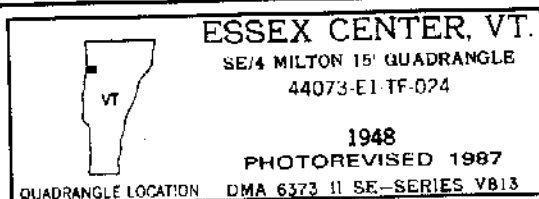
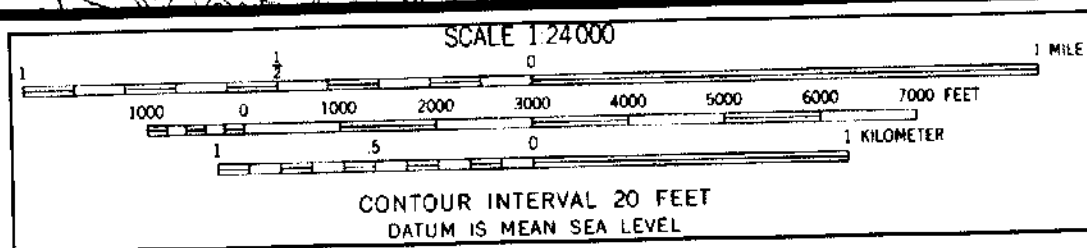
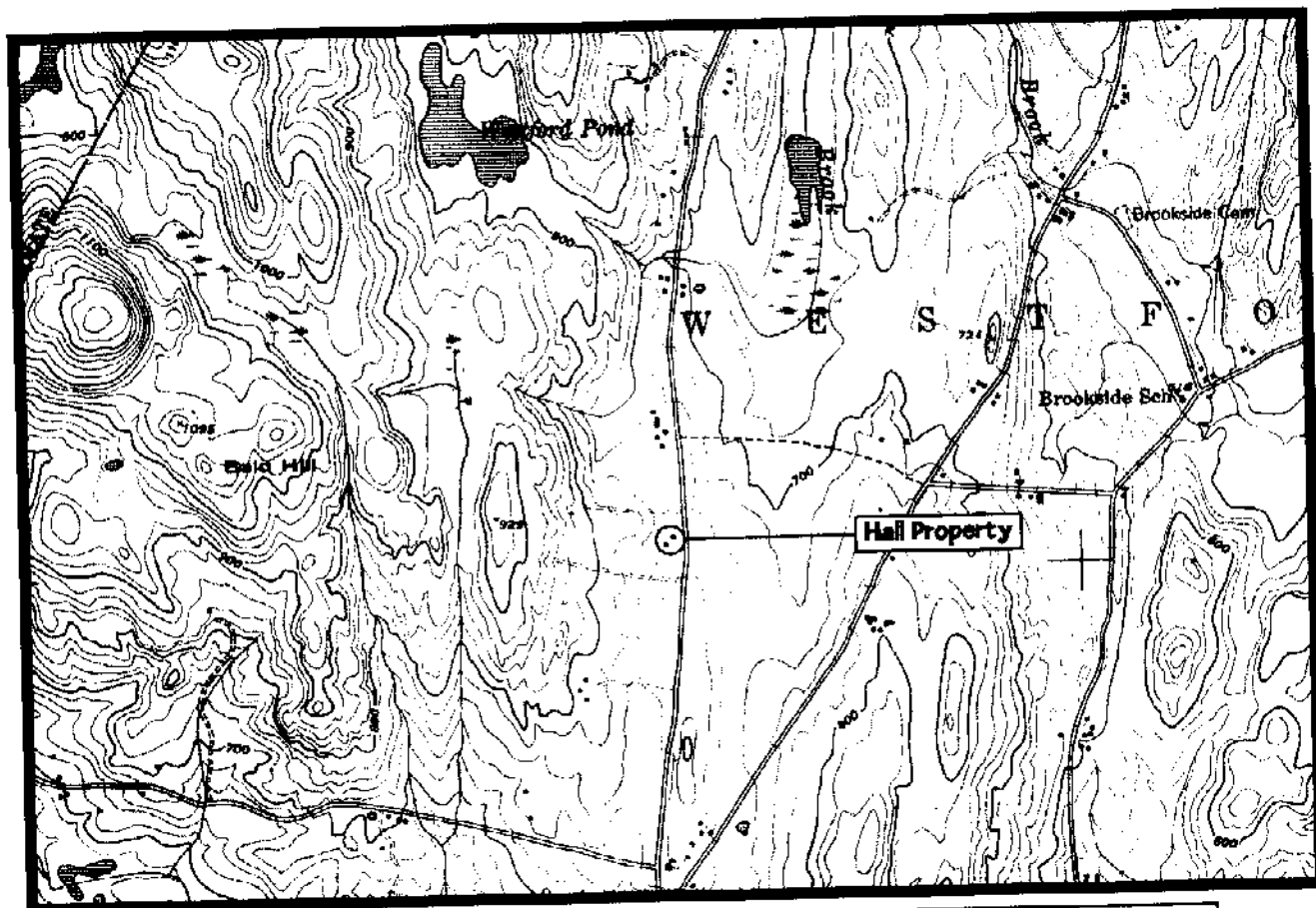
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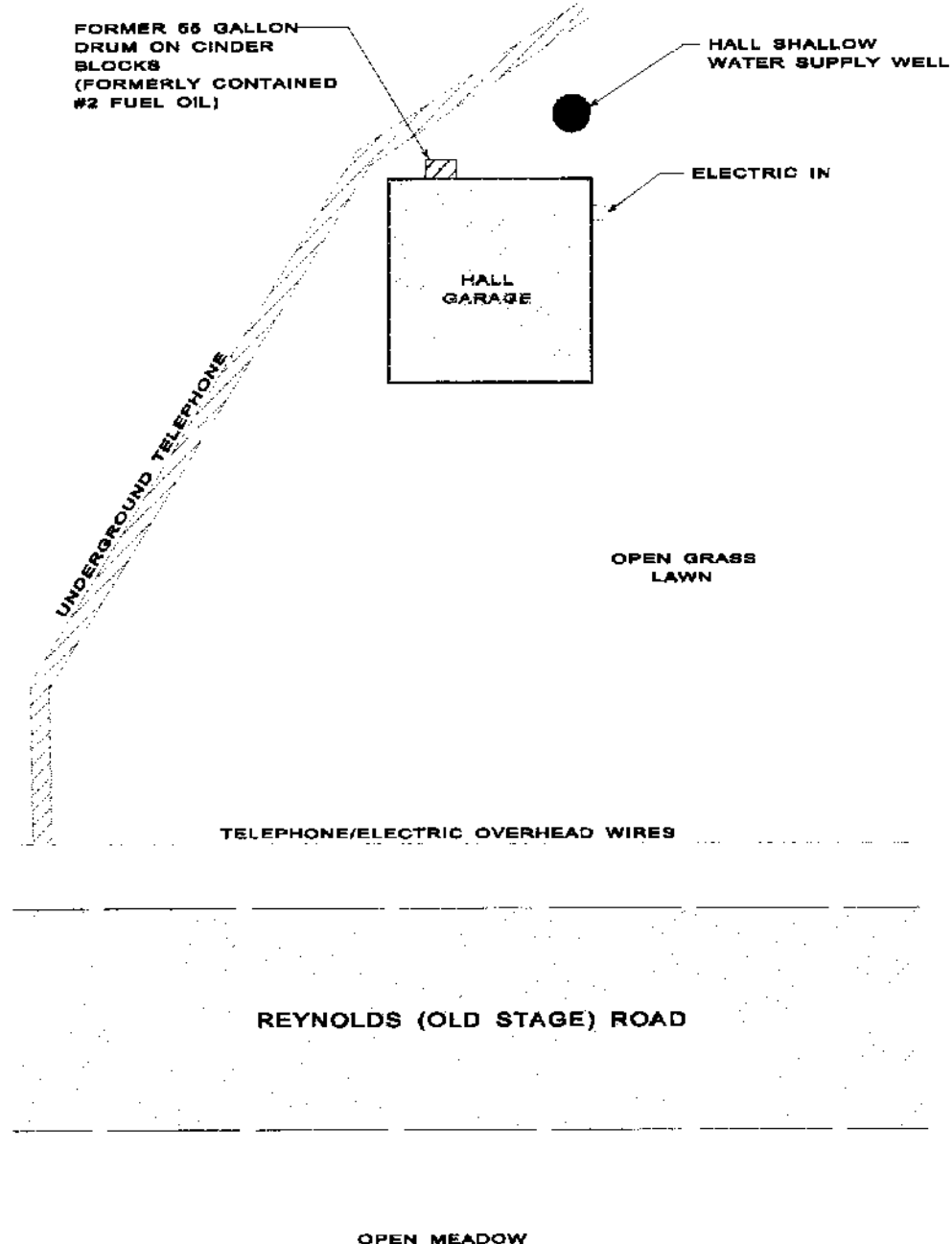
Figure 1

Hall Residence
Westford, Vermont

GENERAL LOCATION MAP



SCALE: 1" = 20'



SCALE: 1" = 10'

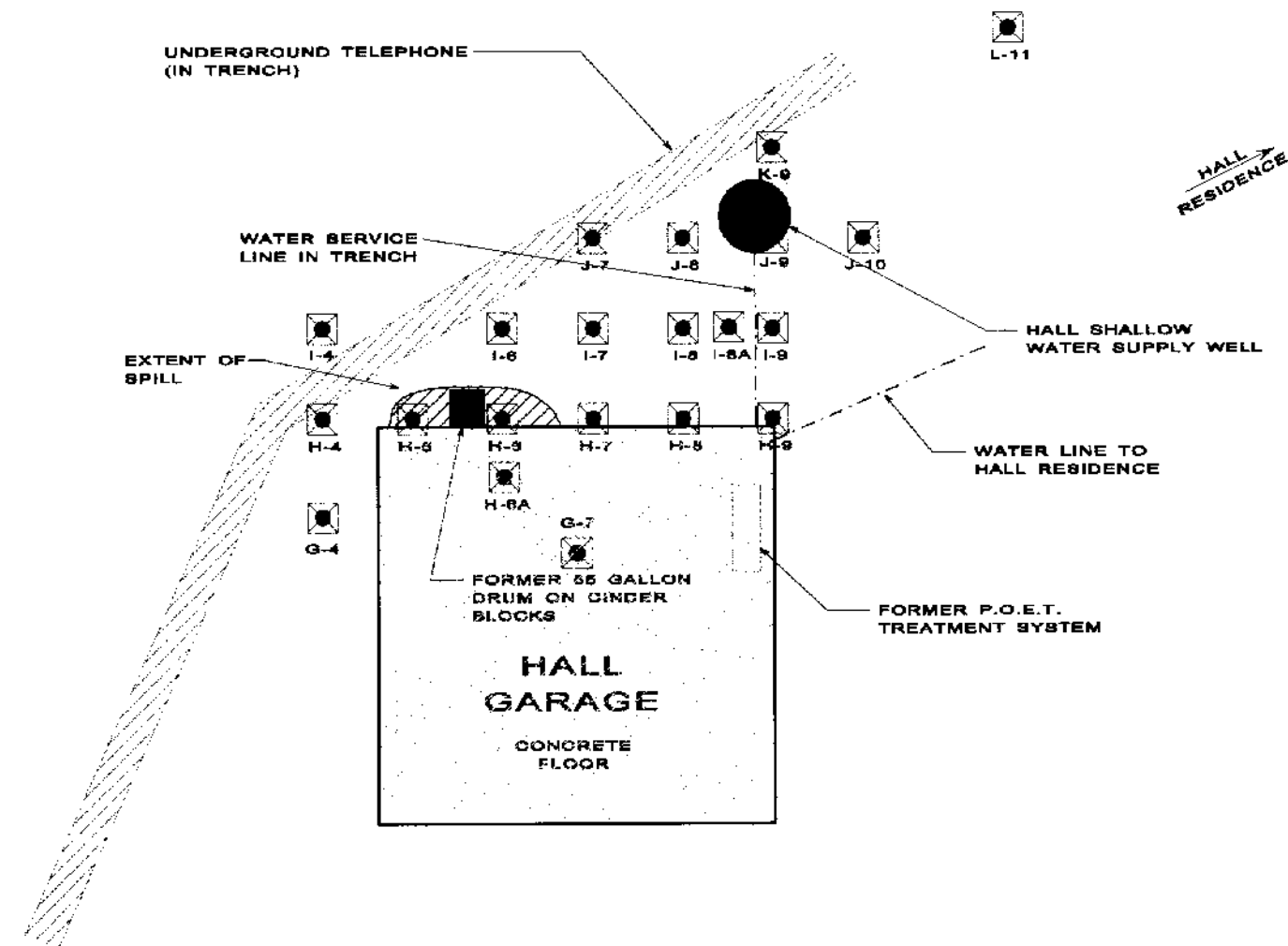


FIGURE 2

HALL RESIDENCE
WESTFORD, VERMONT

SITE MAP
AND
SOIL VAPOR SURVEY
PROBE LOCATIONS

Date:	Job Type:	Scale:
APR '99	PETROLEUM CONTAMINATION	AS NOTED

Project: Hall Residence
Location: Westford, Vermont

Table 1
VDEC Spill # 96-325
Sheet 1 of 1

Photoionization Results (PID - ppm)
October 27, 1998

Probe #	Depth Below Grade			
	1'	2'	3'	3.5'
G4	0.0	0.0	0.0	
G7	0.0	0.0		
H4	0.0	0.0		
H5	27.0	25.6	20.1	1.0
H6	0.0	9.1	0.0	
H6A	0.0	0.0	0.0	
H7	0.0	0.0	0.0	
H8	0.0	0.0	0.0	0.0
H9	0.0	0.0	0.0	
I4	0.0	0.0	0.0	0.0
I6	0.0	0.0	0.0	
I7	0.0	0.0	0.0	
I8	0.0	0.0	0.0	
I8A	0.0	0.0	0.0	
I9	0.0	0.0	0.0	
J5	0.0	0.0	0.0	
J8	0.0	0.0	0.0	
J9	0.0	0.0	29.3	12.8
J10	0.0	0.0	0.0	
K9	0.0	0.0	0.0	
K11	0.0	0.0	0.0	

Notes:
0.0 ppm = Background

Appendix A

Water Quality
Laboratory Reports
for
October 27, 1998

GREEN MOUNTAIN LABORATORIES, INC.

27 Cross Road
Middlesex, Vermont 05602

Phone (802) 223 - 1468

Fax (802) 223 - 8688

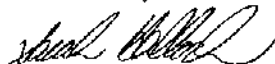
LABORATORY RESULTS

CLIENT NAME:	Lincoln Applied Geology	REFERENCE NO:	4342
ADDRESS:	163 Revell Drive	PROJECT NO:	NA
	Lincoln, VT 05443	DATE OF SAMPLE:	10/27/98
SAMPLE LOCATION:	Hall Residence	DATE OF RECEIPT:	10/28/98
SAMPLER:	Jeremy Revell	DATE OF ANALYSIS:	11/02/98
ATTENTION:	Bill Norland	DATE OF REPORT:	11/03/98

Pertaining to the analyses of specimens submitted under the accompanying chain of custody form, please note the following:

- Water samples submitted for VOC analysis were preserved with HCl.
- Specimens were processed and examined according to the procedures outlined in the specified method.
- Holding times were honored.
- Instruments were appropriately tuned and calibrations were checked with the frequencies required in the specified method.
- Blank contamination was not observed at levels interfering with the analytical results.
- Continuing Calibration standards were monitored at intervals indicated in the specified method. The resulting analytical precision and accuracy were determined to be within method QA/QC acceptance limits.
- The efficiency of analyte recovery for individual samples was monitored by the addition of surrogate analyte to all samples, standards, and blanks. Surrogate recoveries were found to be within laboratory QA/QC acceptance limits, unless noted otherwise.

Reviewed by:



Sarah Hallock
Director of Chemical Services



GREEN MOUNTAIN LABORATORIES, INC.

27 Cross Road
Middlesex, Vermont 05602

Phone (802) 223 - 1468

Fax (802) 223 - 8688

LABORATORY RESULTS

GC/MS METHOD - BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES) + MTBE

GML REF. # : 4342
STATION: P.O.E.T. INFLUENT
ANALYSIS DATE: 11/02/98
DATE SAMPLED: 10/27/98
SAMPLE TYPE: WATER

PARAMETER	PQL (µg/L)	Conc. (µg/L)
Benzene	1	ND
Toluene	1	ND
Ethylbenzene	1	ND
Xylenes	3	ND
MTBE	5	ND

Surrogate % Recovery: 111 %

ND = Not Detected

BPQL = Below Practical Quantitation Limits

NOV - 11 - 98

GREEN MOUNTAIN LABORATORIES, INC.

27 Cross Road
Middlesex, Vermont 05602

Phone (802) 223 - 1468

Fax (802) 223 - 8688

LABORATORY RESULTS

GC/MS METHOD - BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES) + MTBE

GML REF. # : 4342
STATION: P.O.E.T. MID
ANALYSIS DATE: 11/02/98
DATE SAMPLED: 10/27/98
SAMPLE TYPE: WATER

PARAMETER	PQL (µg/L)	Conc. (µg/L)
Benzene	1	ND
Toluene	1	ND
Ethylbenzene	1	ND
Xylenes	3	ND
MTBE	5	ND

Surrogate % Recovery: 111 %

ND = Not Detected

BPQL = Below Practical Quantitation Limits

GREEN MOUNTAIN LABORATORIES, INC.

27 Cross Road
Middlesex, Vermont 05602

Phone (802) 223 - 1468

Fax (802) 223 - 8688

LABORATORY RESULTS

GC/MS METHOD - BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES) + MTBE

GML REF. # : 4342
STATION: P.O.E.T. EFFLUENT
ANALYSIS DATE: 11/02/98
DATE SAMPLED: 10/27/98
SAMPLE TYPE: WATER

PARAMETER	PQL (µg/L)	Conc. (µg/L)
Benzene	1	ND
Toluene	1	ND
Ethylbenzene	1	ND
Xylenes	3	ND
MTBE	5	ND

Surrogate % Recovery: 113 %

ND = Not Detected

BPQL = Below Practical Quantitation Limits

G M L S A M P L E #	Green Mountain Laboratories, Inc.						Analysis Requested								Page 1 of 1	
	27 Cross Road Middlesex, Vermont 05602 Phone (802) 223-1468 Fax (802) 223-8688 E-mail: GML@together.net						MTBE + STPX	TPH & NOM							GML # 4342	
Client Name Lincoln Applied Geology Address 163 Revell Dr. Lincoln Vt 05443 Phone / Fax (802) 453-4384 / (802) 453-5399 Project Name Hall Residence Project Number Project Manager Bill Norlund Sampler Jeremy Revell						Remarks										
#	Sample Location	Date	Time	# of Cont.	Pres.	Sample Type										
1	P.O.E.T. Effluent	10/27/98	1:45	3	Hcl / Nour	H ₂ O		X								
2	P.O.E.T. Mid	↓	1:50	↓	↓	↓		↓								
3	P.O.E.T. Influent	↓	1:55	↓	↓	↓		↓								
4																

Chain of Custody

Relinquished By: <i>Jeremy Revell</i>	Date/Time: 10/28/98	Received By: <i>John Kimball</i>	Date/Time: 10-28-98 0920
Relinquished By: <i>John Kimball</i>	Date/Time: 10-28-98 1410	Received By: <i>John L. Kimball</i>	Date/Time: 10-28-98 1410
Relinquished By: <i>John Kimball</i>	Date/Time:	Received By:	Date/Time:
Temperature Blank:	Vial Lot ID #:		

Green Mountain Laboratories, Inc.

27 Cross Road
Middlesex, Vermont 05602

Phone (802) 223-1468

Fax (802) 223-8688

LABORATORY RESULTS

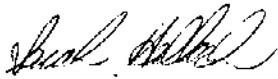
CLIENT NAME:	Lincoln Applied Geology	REF #:	4342
CLIENT ADDRESS:	163 Revell Drive	PROJECT NO.:	NA
	Lincoln, Vermont 05443	DATE OF SAMPLE:	10/27/98
PROJECT NAME:	Hall Residence	DATE OF RECEIPT:	10/28/98
SAMPLER:	Jeremy Revell	DATE OF ANALYSIS:	11/03/98
ATTENTION:	Bill Norland	DATE OF REPORT:	11/09/98

Total Petroleum Hydrocarbons (TPH) by EPA Method 8100M (mg/L - ppm)

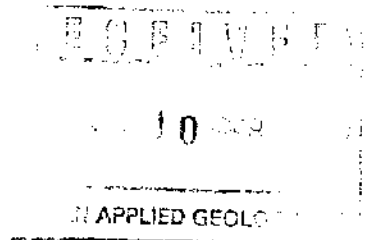
Sample	PQL	TPH Results
P.O.E.T. Effluent	0.05	0.05
P.O.E.T. Mid	0.05	<0.05
P.O.E.T. Influent	0.05	0.25

PQL= Practical Quantitation Limit

Reviewed by:



Sarah Hallock
Director of Chemical Services



Green Mountain Laboratories, Inc.
Cooler Receipt Form / Routine

DATE RECEIVED: 10/28/98

GML #: 4 3 4 2

CLIENT: LAG

PROJECT: Hall Residence

C.O.C. INSPECTION

- | | | |
|---|--------------------------------------|----|
| 1) Were custody paper(s) filled out properly (ink, signed, etc.)? | <input checked="" type="radio"/> YES | NO |
| 2) Did you sign custody paper(s) in all appropriate places? | <input checked="" type="radio"/> YES | NO |
| 3) Did you assign a GML Sample # to each sample on C.O.C.? | <input checked="" type="radio"/> YES | NO |
| 4) Was the project identifiable from custody paper(s)?
(If YES, enter project name at the top of this form.) | <input checked="" type="radio"/> YES | NO |

PHYSICAL INTEGRITY INSPECTION / LOG-IN

- | | | |
|---|---|----|
| 5) Did all bottles arrive unbroken & were labels in good condition? | <input checked="" type="radio"/> YES | NO |
| 6) Were all bottle labels complete (ID, date, time, signature, preservative, etc.)? | <input checked="" type="radio"/> YES | NO |
| 7) Did all bottle labels agree with the custody paper(s)? | <input checked="" type="radio"/> YES | NO |
| 8) Were correct preservatives added to samples? | <input checked="" type="radio"/> YES | NO |
| 9) Were correct containers used for the tests indicated? | <input checked="" type="radio"/> YES | NO |
| 10) Was a sufficient amount of sample sent for the test(s) requested? | <input checked="" type="radio"/> YES | NO |
| 11) Were bubbles absent from volatile samples?
(If NO, list by GML Sample # on the back of this form.) | <input checked="" type="radio"/> YES | NO |
| 12) Were copies of the C.O.C. distributed correctly?
(Sampler, C.O.C. record, billing, analyst(s), director, original at front desk?) | <input checked="" type="radio"/> YES | NO |
| 13) Did you enter the job correctly in the sample log and disposal log? | <input checked="" type="radio"/> YES | NO |
| 14) Were samples placed in the correct refrigerator(s)? | <input checked="" type="radio"/> YES | NO |
| 15) Was the project manager called and the status discussed?
(If YES, give details on the back of this form. Who was called, by whom, date?) | YES <input checked="" type="radio"/> NO | |

LOG-IN BY (INITIALS): SLK

Use other side of this form to note details concerning sample acceptance problems.

